

Color Management in Digital Printing

With ever higher expectations for fast turnover, competitive pricing, consistency and quality in the print industry, we can safely say that print production in today's market is virtually impossible without color management. This is even more true in digital printing. In this article we'll learn

- Why **Color Management is essential for the digital printing** realm
- Which **areas of digital printing** are affected when applying color management

While there are certainly standardised procedures for using Color Management for analog printing processes, there is no standardised procedures for digital printing in this respect. The two processes are extremely different, as digital printing is used in various areas – *packaging, labels, large format, textiles, ceramics, glass, etc.* The application of Color Management in the digital printing realm is essential when we wish to fulfil the following requirements:

- **Application of light inks** – In order to reduce the granularity of low-resolution printing systems in bright areas, light inks are often used in digital printing. The amount of light colors and with which hue light colors are applied must be spectrally analysed and the transition between light and process inks calculated. In certain color management systems, the calculation result is also represented in the form of a DeviceLink profile.
- **Application of non-standard colors** – In classical printing CMYK colors and special colors such as Pantone, RAL or HKS - are practically standard in the industry. Digital printing on the other hand uses color spaces such as CMYK colors whose color locations differ greatly from typical colors. Color spaces may be limited to completely different primary colors – e.g. blue, orange, red, green, yellow, brown, etc. The latter point is mainly used in ceramic printing, where, for example, a clean magenta can only be achieved by adding gold, where the price of ink can be prohibitive.
- **No use of special inks** – While flexo printing in particular tends to rely heavily on the use of special inks, offset printing uses special inks only for specific applications such as: varnishing, imaging CI inks and creating effects. In digital printing, Spot Colors are rarely used, but Spot Colors from the Pantone and HKS environment have to be reproduced using the basic colors, in many cases this is only possible with a very large ΔE value. Other Spot Colors must therefore be used in digital printing such as white, varnish and colors for the pre-treatment of a material, which allows printing on materials which were previously unprintable.
- **Use of Gamut Expanding inks** – Typically in offset printing Gamut Expanding inks are rarely used, digital printing systems are augmented with Gamut Expanding inks such as orange, green and violet in addition to CMYK inks. This addition of colors can reproduce an extraordinary color range, which in turn enables the printer to achieve color values similar to that of Pantone, RAL or HKS color systems. Additionally, the [total ink application](#) for

special colors can be reduced, which typically has a positive effect on drying behavior and applied thickness of printed inks.

- **A diverse array of Substrates** – While the classic printing processes are generally limited to printing on paper, digital printing achieves what the latter cannot. In order for a substrate to be printed upon, the ink must adhere to the substrate. Many materials have to be pre-treated in advance or directly at the printer. Due to different surface textures – rough, smooth, wavy etc., not to mention the use of opaque and transparent substrates, as well as optical brighteners especially for fabrics – the spectrum is so wide that one cannot speak of a single color space in digital printing but rather thousands of color spaces. **To optimise and fully exploit the color space of a substrate, every substrate should be profiled.**



Working with only one Profile

- In order for the color space of a Substrate to be fully exploited, it is essential that every Substrate is individually profiled. The use of »one« profile is no longer sufficient, as this will result in inconsistent and sub-optimal results for your customers.

- **Various Ink Types** – Different methods for printing color images are available on the market. Colors can, for example, be applied by toner particles or ink droplets. There are also different types of inks, such as UV and Water Based Inks, each of which have completely different drying characteristics. Depending on the printing mode, the glossiness of an ink can also be strongly influenced, and in some cases can replace the varnishing process completely. These variables must be taken into account when profiling if you want to get the maximum color from your printing system.
- **Direct and Transfer Printing** – How color is applied as well as pre- and post treatment of substrates strongly influences the saturation and over all color quality of a print. For example, temperature differences in the **Calenders** (rollers) of a press (mostly used for textiles) can be an essential factor. All processes must be scrupulously carried out to ensure consistent color reproduction. When necessary Color Management can compensate for small deviations in color.
- **Altering Printhead Performance** – Printheads are expensive and not easy to replace. Printheads are also subject to ageing, which means that printhead performance inevitably degrades over time. With Color Management, fluctuations in printhead performance can be compensated for by re-linearization or reprofiling a color setup. Adjusting printhead performance by raising the printhead tension can also lead to the desired result.
- **Adaptation of Printing Systems** – If the same printing systems are used, and these systems are e.g. of different age, the printing systems are generally required to print as equally as possible. To achieve this, Color Management can be used to adapt the color of the new printing system to the old system.
- **Perception differences** – In classical offset and flexo printing the perception of gray is standardised, the desire for a cooler gray, especially within the large format environment is gradually becoming an industry necessity.

The same demand concerning black is also becoming more relevant. These industry demands have to be standardised via the Color Management, because such a process is not consistent when applying a simple color correction on a print item basis for example.

- **Managing Consumption** – Beside to make the process as simple as possible and reduce the amount of clicks required to accomplish a specific result – e.g. printing using CMY without black or only black without CMY – the only factor that counts in inkjet printing systems is how much ink is used for printing. Since digital inks are very expensive compared to offset inks, the only viable option with digital printing systems is to reduce the application of ink as much as possible. To achieve this, a Color Management system must have a wide range of options available in order to precisely control ink consumption in terms of the use of *gamut expanding colors* and black instead of other primary colors to replace dark colors. There are no standards in this area, as each print can be printed in multiple ways depending on factors such as colors used and the number of colors printed.

As we've read in the previous paragraphs; this subject is very complex and must be understood by the user if the maximum level of color application needs to be obtained while at the same time saving money on printing ink should be considered - as well as using special colors or trying to achieve a similar result compared to an existing offset print job.

In this respect, the challenge in developing the Workflow was to integrate this complex topic in an understandable and above all transparent way in one user interface. The possibilities offered by the Workflow in terms of Color Management are enormous – those who engage and master handling colors will save money and be able to deliver print results that can satisfy any customer.